# Assessing source areas of pollutants from studies of fly ash, charcoal, and pollen from Svalbard snow and ice

**Elisabeth Isaksson**
Norwegian Polar Institute, Tromsø, Norway

**Sheila Hicks,**
Institute of Geosciences, University of Oulu, Oulu, Finland

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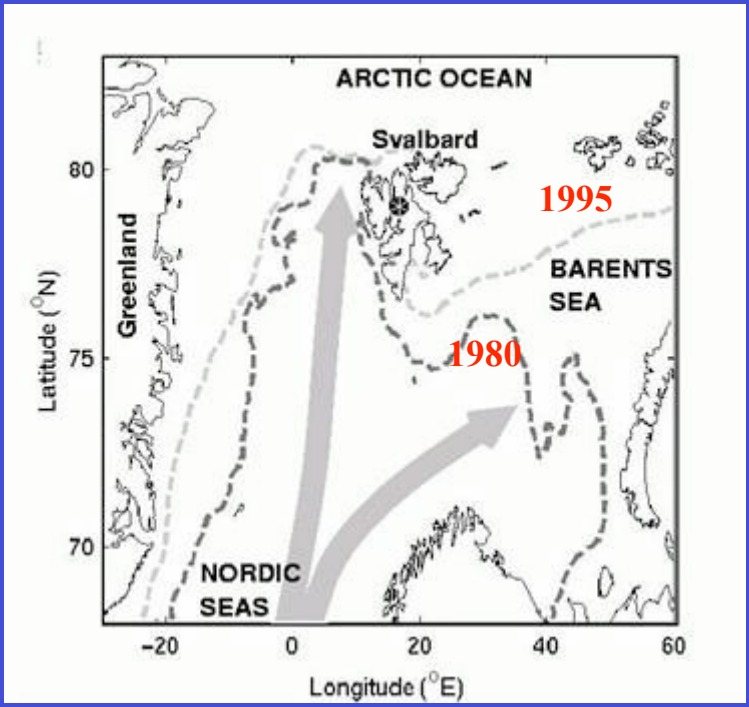
# Svalbard is positioned in a climatically sensitive area




**Sensitive to changes in the:**

- ***North Atlantic Current***
- ***Sea ice extent***
- ***Atmospheric circulation***

**About 60% is ice covered**

# Svalbard ice cores

**Do ice cores from sites with substantial summer melt provide any useful climate-environmental data?**

Yes!

**Svalbard ice cores can provide information on both local and regional climate variability in the Arctic depite their low altitude and periodic melt.**

# Ice core sites


**Austfonna (750 masl)**

**drilled in April 1999**

**289 m deep, about 800 yrs**

**Project participants: Japan and Norway**

**Holtedahlfonna (Snøfjellafonna)**

**drilled in April 2005**

**125 m deep, about 400 yrs**

**Project participants: Norway, The Netherlands, Sweden, Finland, Estonia**

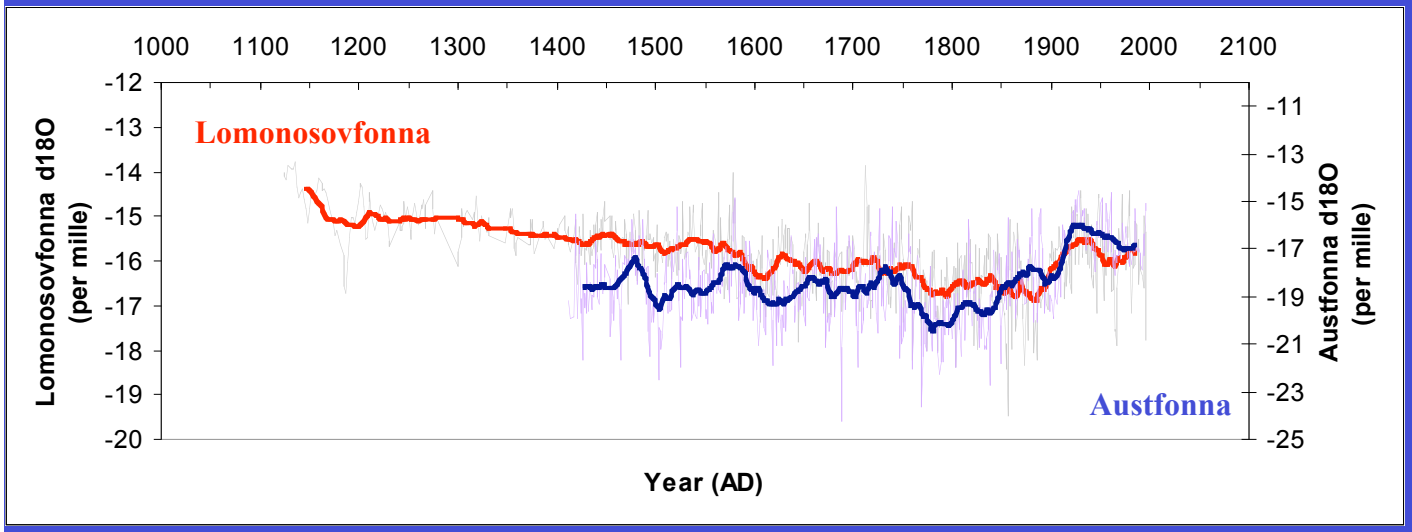
**Lomonosovfonna (1250 masl)**

**drilled in April 1997**

**121 m deep, about 800 yrs**

**Project participants: Norway, The Netherlands, Sweden, Finland, Estonia**

# Svalbard climate during the past 1000 years from ice core $\delta^{18}O$ records




The $\delta^{18}O$ record from Lomonosovfonna suggests that temperatures during the early part of the record about 1100-1500 AD (Medieval warm period) was at least as warm as the 1900s. However, the record ends in 1997 thus excluding the last exceptionally warm years.

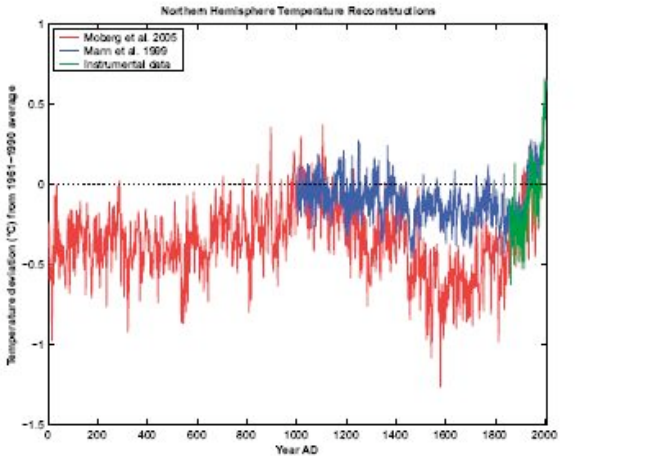
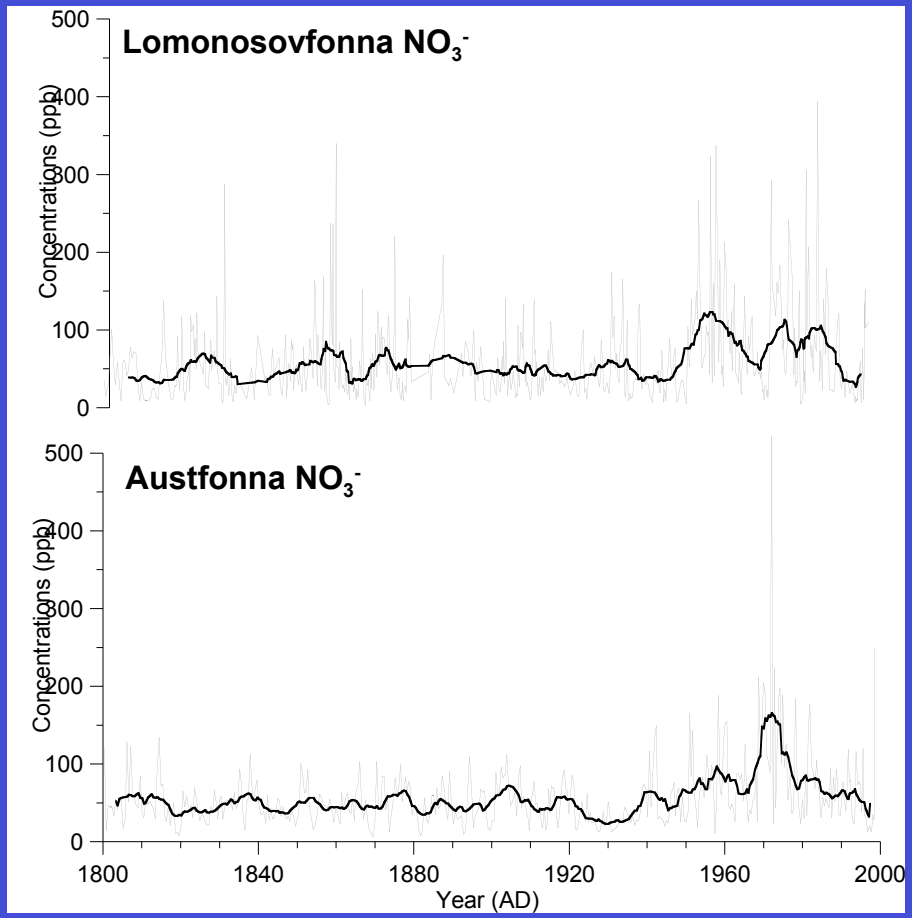



*Figure 1-1. Northern Hemisphere annual mean temperature reconstructions from proxy data by /Mann et al. 1999/ and /Moberg et al. 2005a/. The instrumental record from the Climatic Research Unit, updated from /Jones and Moberg 2003/, is also shown.*

The Svalbard data have good resemblance with NH proxy temperature reconstructions

# Pollution records from the ice cores

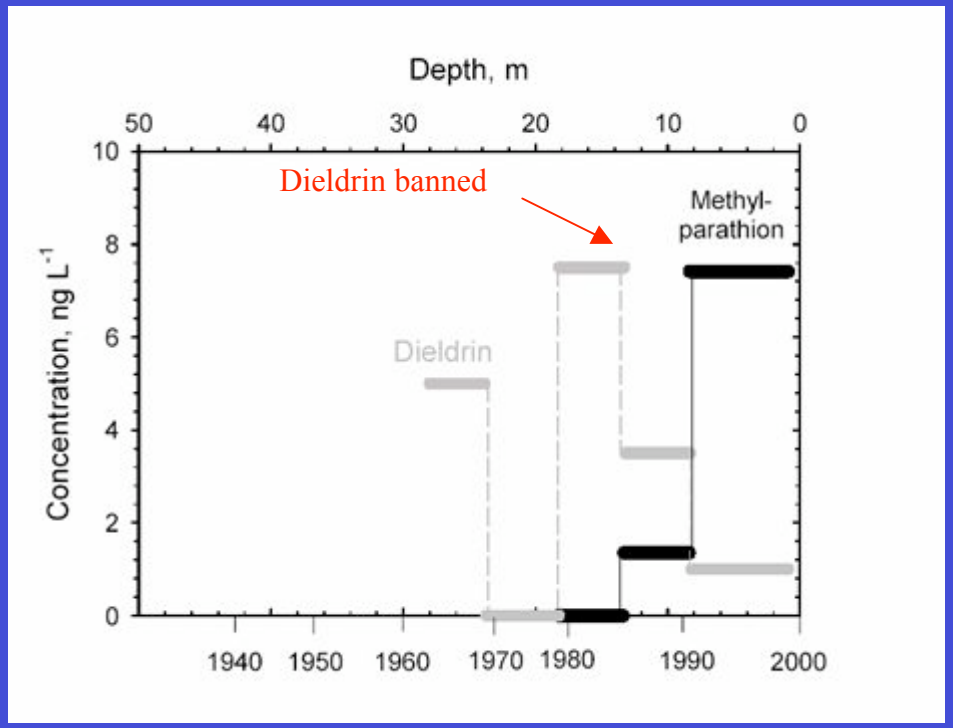



Nitrate records from two Svalbard ice cores

# Contaminant studies in Svalbard snow and ice

*Mark Hermanson, University of Penn., Philadelphia, USA*
*Derek Muir, Env. Canada, Burlington, Canada*

## Example of two Pesticide records




**Profiles of methyl parathion and dieldrin in the Austfonna ice core.**
**The relatively high concentrations of methyl parathion in near surface layers suggest a current use and growing inputs while dieldrin shows declining input since the late 1970s.**

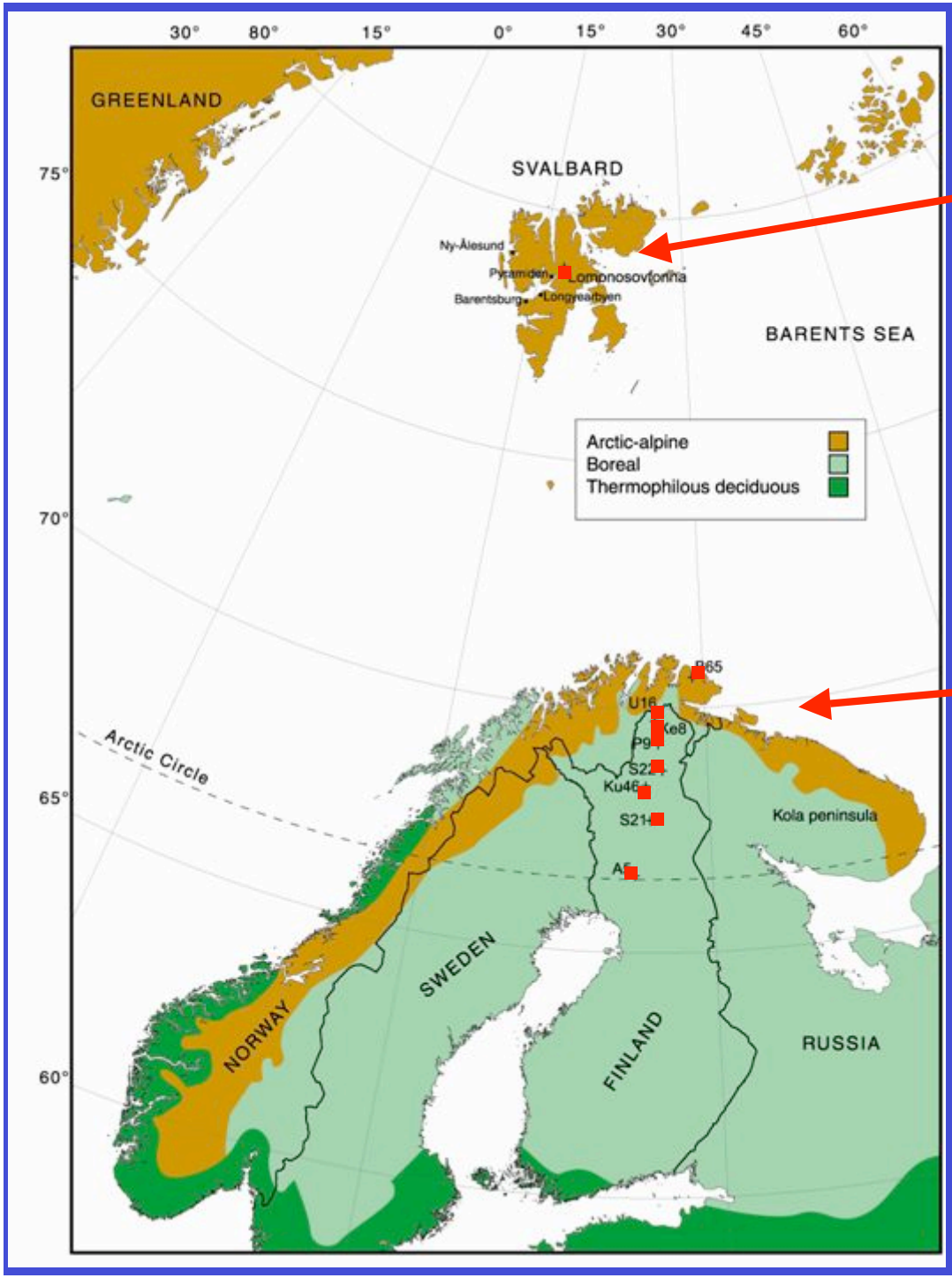
# Pollen

- can give information on trajectories and transport distances
- carriers of contaminants

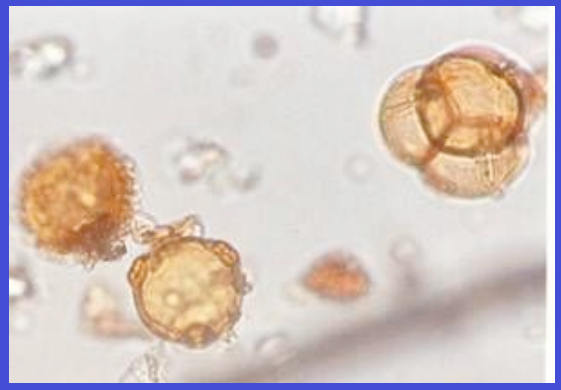
Typical birch vegetation in Northern Scandinavia

Pollen trap

Betula and Vaccinum

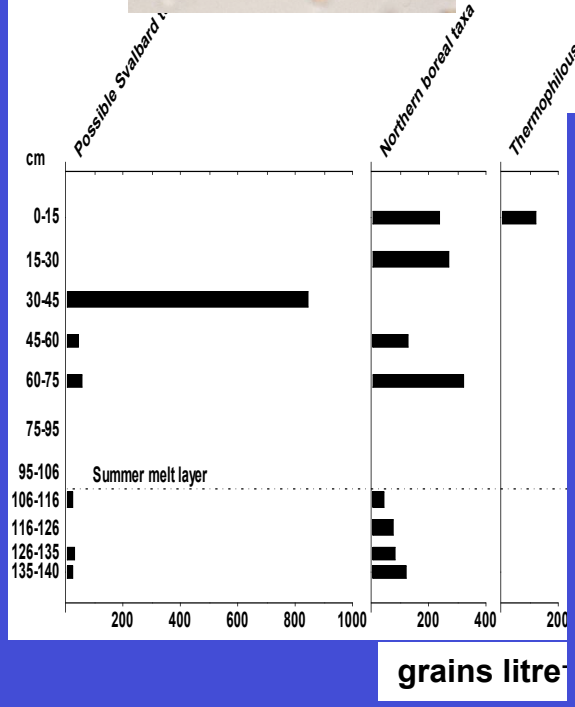



Ice core site



Pollen trap sites in northern Finland

# Snow Pit 2002



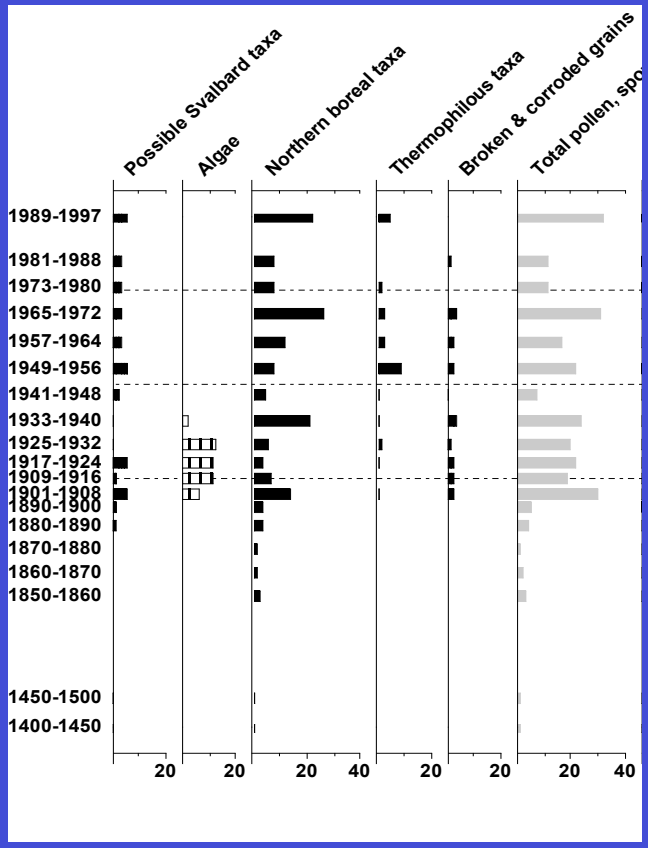

Pollen, charcoal and SCP concentrations appear to be higher in the winter than summer layers. Indicates that E and SE dominating winter winds are responsible for the transport.

Snow pit surface April 2002

Winter 2001-2002

Summer 2001

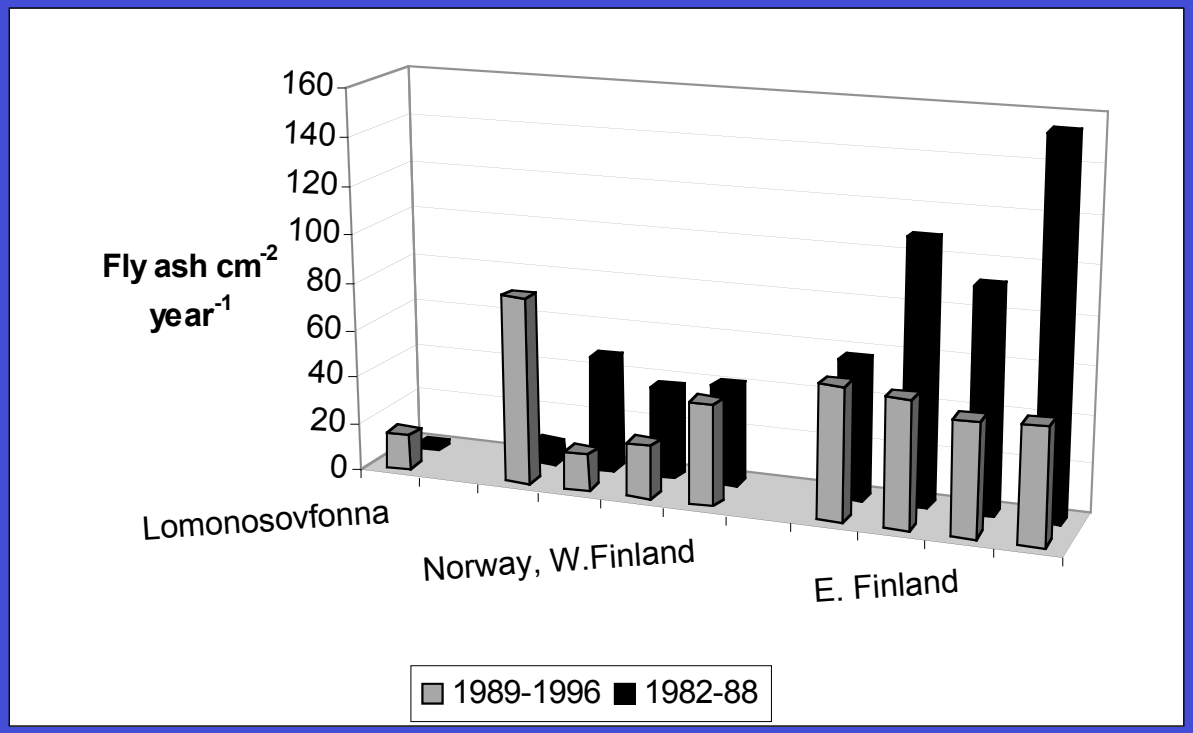
# Long-term variability




**Pollen of northern boreal and thermophilous taxa are more common than local Svalbard taxa**

**SCP in agreement with industrial history**

# SCP records from northern Scandinavia and Svalbard




**SCP was lower in the pollen traps during the 1990s than 1980s**

**Much higher SCP in the pollen traps than in the ice core**

# Main results from pollen, BC work

- **Pollen, charcoal and SCP seem to arrive to this ice cap all year round**
- **Pollen of northern boreal and thermophilous taxa are more common than local Svalbard taxa, *i.e.* confirms long-distance air mass movements**
- **No specific North American pollen found- probably European sources**
- **The SCP record is in agreement with the ”industrial history”**
- **Viewing data from snow, ice and pollen traps together allows particle transport to be assessed at different temporal scales**
- **Viewing pollen and SCP together could be a new approach for tracing origins of contaminants**

# Future plans

- **BC work on newest ice core drilled 2005 together with J. Ström**
- **Investigate links between atmosphere and snow by integrating data from Zeppelin station with snow and ice core data**

Zeppelin station Ny Ålesund